

**Amendments to the Drawings:**

Examiner approval of the proposed drawings changes shown on the  
attached replacement sheets is respectfully requested.

**REMARKS**

Claims 1-5 were examined in the Office Action mailed October 12, 2006, with claim 6 standing withdrawn pursuant to Election/Restriction Requirement.

The following objections are rejections are pending:

- The drawings stand objected to for failure to illustrate the mechanical and hydraulic adjuster recited in claim 5.
- Claim 1 stands objected to for an informality.
- Claim 3 stands rejected under 35 U.S.C. § 112, second paragraph for an antecedent basis issue.
- Claims 1-2 and 4-5 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,595,207 to Popp ("Popp").
- Claim 1 stands rejected under § 102(b) as anticipated by U.S. Patent No. 5,029,875 to Spain, *et al.* ("Spain").
- Claim 3 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Spain, in view of U.S. Patent No. 4,330,234 to Colley ("Colley").

The Applicants respectfully submit the foregoing amendments and following remarks.

1. **The Drawing Objection Has Been Addressed.** In response to the pending drawing rejection, the Applicants are requesting Examiner approval of the attached Replacement Sheets. The proposed drawing changes add a drawing symbol indicating a mechanical and/or hydraulic actuator for rotating the adjusting nut 34 shown in Figs. 1 and 2, consistent with the provisions of 37 C.F.R. § 1.83(a) ("However, conventional features disclosed in the description and claims, where their detailed illustration is not essential for a proper understanding of the invention, should be illustrated in the drawing in the form of graphical drawing symbol or a labeled representation (e.g., a labeled

rectangular box).”) The Applicants respectfully submit that those of skill in the art would immediately recognize that there are a variety of mechanical and/or hydraulic ways to drive the adjusting nut 34. Accordingly, the Applicants submit that detailed illustration of a specific adjusting nut drive mechanism “is not essential for a proper understanding of the invention” (the present approach to providing a resettable brush seal), and therefore the labeled illustration is sufficient for the purposes of § 1.83.

Concurrent with the drawing changes, the Applicants are amending Specification ¶ [0024] to refer to the new reference label 42. The Applicants respectfully submit that in view of the original claim 5 recitation (which is a part of the original specification), and the description in the Specification of the axial movement of the case housing (which necessarily must have some means of actuation in order to cause the motion), the addition of a reference to the mechanical and/or hydraulic actuator in ¶ [0024] does not add new matter.

Approval of the proposed drawing changes and withdrawal of the pending drawing rejection is respectfully requested.

**2. Claim Objection and § 112 Rejection Have Been Addressed.** In accordance with the Examiner’s helpful suggestion, the Applicants have amended claim 1 to refer to “the first component.” As to the pending § 112, second paragraph rejection, the Applicants have addressed the antecedent basis issue in the foregoing amendments to claim 1. Withdrawal of the pending claim objection and § 112, second paragraph, rejection is respectfully requested.

**3. The Amended Claims Are Patentable Over Popp and Spain.** The Applicants respectfully traverse the rejections of claims 1-5 as anticipated by, or unpatentable over, Popp, Spain and/or Colley, on the ground that these references fail to disclose or suggest all of the features of the present invention recited in amended claim 1 and its dependent claims 3-5.

**The Present Invention:** The present invention is directed to a novel arrangement for sealing a gap between an end of a shaft and an adjacent housing, in which an annular brush seal which seals against a tapered, radially outer surface of the shaft end is axially displaceable, such that the brush seal is readily adjustable to provide a desired gap at initial installation (thereby saving costs by eliminating the need for a highly precisely-dimensionally controlled brush seal), and may be quickly and easily adjusted to accommodate brush wear, etc., during the seal's life (thereby saving large maintenance costs and minimizing unprofitable machinery down-time). Specification at ¶¶ [0010]-[0012].

Consistent with the foregoing, the Applicants have amended claim 1 to incorporate the limitations of claim 2, and to clarify the relative arrangement of the first and second components. A conforming amendment has also been made cancelling claim 2, without prejudice to the subject matter therein. As amended, claim 1 recites that the sealing surface of the second component “is a surface of a shaft end of the second component which is conical in form,” and that the axially displaceable first and second components are arranged, for example as shown in Figs. 1, 2, with “the first component being disposed axially adjacent to the second

component shaft end,” with “means for axial displacement and adjustment being provided between the first component and a casing surrounding the first component.”

The Cited References:

Popp: The Popp reference discloses a conically-shaped brush seal 3 which is maintained at fixed distance from a corresponding conical face 5 of a rotating component 1. As typical in the prior art, this reference does not provide for any adjustment of the brush engagement with the seal surface in either the axial or radial directions, and accordingly suffers from the disadvantages addressed by the present invention (*e.g.*, need for costly high-precision brush assembly production, need for costly and time-consuming machinery disassembly to replace worn seals, inability to alter seal gap to reduce leakage).

The Applicants respectfully note that the Examiner’s comments suggesting that the Popp components “are capable of being axially displaceable and adjustable with respect to the other component” (emphasis in original) are not based on any actual disclosure in the Popp reference, and therefore the Examiner’s post-hoc speculation as to features not taught by the reference (*i.e.*, the unsupported assertion that the components are axially displaceable) cannot substitute for the requirement of identifying *all* of the features of a claimed invention in the cited reference.

In this case, there is absolutely no disclosure or suggestion of axial displacement of the two components relative to one another – a fact which is perfectly in accord with the prior art, which consistently employed fixed-position

brush seals to seal the end of rotating shafts, such as gas turbine shafts. Indeed, Popp Fig. 4 teaches the opposite – opposing brush seals which have opposite-facing seal surfaces which must remain in a fixed position (centered between the seals) in order to preserve the seal on both surfaces.

Moreover, one of skill in the art would recognize these references teach machines whose axial free-play is normally carefully controlled to *prevent* axial motion between the rotating component and its housing. Indeed, the present invention does not purport to axially displace the rotating component (*e.g.*, a turbine rotor), but instead recites that the first component, to which the brush seal is fixedly located, is displaced axially. Amended Claim 1 (the first component is “disposed axially adjacent to an shaft end of the second component” and there is provided “means for axial displacement and adjustment being provided between the first component and a casing surrounding the first component”).

Because the Popp reference fails to disclose or suggest amended claim 1’s seal arrangement including “means for axial displacement and adjustment being provided between the first component and a casing surrounding the first component,” or as a threshold matter fails to disclose any axial displacement to maintain a desired seal, amended claim 1 and its depending claims are patentable under § 102(b) over Popp. Reconsideration and withdrawal of the § 102(b) rejection based on Popp is respectfully requested.

Spain: The Spain reference also discloses an axially-fixed seal-to-rotating component arrangement. Spain teaches making a seal material 34 long

enough to make substantial contact with a conical receiving surface 12, *i.e.*, the tip region of the seal is elastically deformed away from a perpendicular radial position, so that as the seal wears (and thus is shortened), the seal tip remains biased against the conical surface to maintain the seal.

As with Popp, Spain contains no disclosure, or even a suggestion, of any means for axial displacement a brush seal relative to its rotating component. Also like Popp, the assertion that the Spain components are axially displaceable is not supported by any disclosures in Spain. Further, in view of both the lack of teaching or suggestion in the art for such relative motion and the further silence of Spain on this subject, it cannot be fairly asserted (at least without the benefit of hindsight) that this reference somehow teaches this feature of claim 1. Accordingly, claim 1 is also patentable under § 102(b) over the Spain reference.

The Combination of Spain and Colley: The Colley reference fails to cure the deficiencies of Spain. Colley is cited as teaching claim 3's seal axial displacement means comprising "a sliding seat an adjustment nut which is fitted into the casing and a displacement screw thread cut into the first component." Specifically, Colley is asserted to teach "the placement of the brush seal as well as a sliding seat (e.g. 29), and adjustment nut (e.g. 31) and a displacement screw thread (e.g. screw threads of screw located near elements 33-35)." October 12, 2006 Office Action at 6.

Colley actually teaches a turbine fan blade tip gap-minimizing arrangement (as a first matter, not the claimed shaft seal arrangement, nor a brush seal arrangement), in which a *radial* clearance-adjustment mechanism

moves an “annular shroud 18” *radially* toward or away from the tips of the turbine blades. The Applicants respectfully submit that there is no suggestion in either Spain (with a fixed seal/rotor relationship) or Colley (with a middle-of-the-turbine, radially-directed blade tip clearance adjuster), for the combination of these references to obtain the claimed axially-displaced, axial end-arranged brush seal apparatus – and even if there were such a suggestion, the present invention would not result, as the addition of Colley’s radial shroud adjustment mechanism to the end of the Spain turbine would not result in the claimed sealing arrangement “with the first component being axially displaceable and adjustable with respect to the second component, the first component being disposed *axially adjacent to* the second component shaft end, and means for axial displacement and adjustment being *provided between the first component and a casing surrounding the first component.*”

For the foregoing reasons, the Applicants respectfully submit that claims 1 and 3-5, as amended, are patentable over the Popp, Spain and/or Colley references under § 102(b) and § 103(a). Reconsideration and withdrawal of the pending rejections is respectfully requested.

### CONCLUSION

The Applicants respectfully submit that claims 1 and 3-5 are in condition for allowance. Early and favorable consideration and issuance of a Notice of Allowance for these claims is respectfully requested.

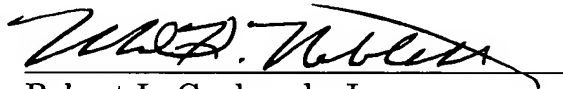


If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #011235.55710US).

Respectfully submitted,

December 22, 2006

A handwritten signature in black ink, appearing to read "R. L. Grabarek, Jr.", written over a horizontal line.

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